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STUDIES ON THE EFFECT OF SEAWEED LIQUID FERTILIZER (SLF) ON DIFFERENT GROWTH PARAMETERS, BIOCHEMICAL CONSTITUENTS AND PIGMENT PRODUCTION IN A C_3 PLANT, ORYZA SATIVA

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ABSTRACT

Seaweeds constituting important renewable marine resources grown in intertidal regions of the sea and serve as excellent sources of food, fodder, fertilizer and industrial raw material for the production of phycocolloids like agar, carageenan and antimicrobial agents. The purpose behind the use of sea weeds is to increase the yield of plants. The extract from sea weeds are commonly called as sea weed liquid fertilizer are now commercially available in several trade names such as Algin, Algifert, Maxicorp etc. The use of biofertilizer will be helpful to sustain soil fertility and pollution free soil environment. Seaweed extract from *Ulva fasciata* and *Sargassum swartzii* have been found to increase the yield of C_3 plant *oryza sativa.* The different growth promotors auxins, gibberellins and cytokinines has been reported and enhance the growth of C_3 plants. The biochemical constituents such as soluble sugar, protein and Lipid, pigments Chlorophyll a, Chlorophyll b and Xanthophyll were experimentally proved.

KEYWORDS: Seaweed Liquid fertilizer, Algin, Algifert, Auxin, Gibberellin, Chlorophyll and Xanthophyll.

1. INTRODUCTION:

Marine macroalgae occupies a primitive position in the evolutionary tree and shows the remarkable morphological diversity, function, tolerance to extreme environmental conditions. In India, seaweed is used only as manure. The application of seaweed and seagrass extracts not only promotes growth and yield of plants but also enhances the disease resistance capacity in horticulture crops. In many countries, seaweeds are at present used in agricultural and horticulrural as meal and liquid extract.

Seaweeds are important sources for food, fodder, fertilizer and medicine from the ancient times. The prime aim of use of seaweeds as SLF in plants is to increase the productivity of crop plants to meet out the increasing need for food products. The purpose behind the use of seaweeds is to increase the yield of plants (Bokl *et al.,* 1974). Certain edible seaweeds contain significant quantities of proteins, lipids, minerals and vitamins (Norziah *et al.*, 2002). Different species of seaweeds especially protein rich seaweeds are used as human food in different countries all over the world. Seaweeds constitute the most essential live organisms used on a wide scale commercially and the extracts from seaweeds are commonly called as seaweed liquid fertilizer (SLF) (Bai *et al.*, 2007).

Seaweed manure besides increasing the soil fertility increases the moisture holding capacity and supplies adequate trace elements thereby improving the soil structure (Dhargalkar and Neelam Peseira, 2005).

The fast growing population is mounting tremendous pressure in food production in the country. To meet the increasing demand farmers use chemical fertilizers to enhance the crop production. The toxic chemicals (arsenic and cadmium) from chemical fertilizers accumulate in plant products cause health problems in human beings by biomagnifications (Hansra, 1993). In recent years, the use of seaweeds as fertilizers has been allowed as a substitution place of conventional synthetic fertilizers (Hong *et al.*, 2007; Crouch and Van Staden, 1993).

2. MATERIALS AND METHODS:

Healthy seaweeds of *Ulva fasciata* (Chlorophyceae) and *Sargassum swartzii* (Phaeophyceae) were collected from Kadiapatnam coast of Kanyakumari District, Tamilnadu. *Ulva fasciata* is commonly found on intertidal rocks, in tide pools and on reef flats. *Sargassum swartzii* is distributed on exposed surface of the larger rocks.

C_3 plant *Oryza sativa* was selected for the present investigation to understand their growth, biochemical characteristics and yield with reference to the effect of SLF's obtained from *Ulva fasciata,* and *Sargassum swartzii*. Healthy viable seeds of the experimental plant was obtained from Tamilnadu Agricultrual Office, Kurunthancode, Kanyakumari District, India. Seeds showing 90% viability were selected for the study.

Algae collection and the preparation of Seaweed Liquid Fertilizer (SLF) followed by the standard procedure of Rama Rao K (1990).

3. RESULTS:

Effect of different concentrations of SLF of *Ulva fasciata* and *Sargassum swartzii* on different growth parameters of *Oryza sativa*.

The effect of SLF was clearly evident in all studied parameters over the control plant. For instance the number of flowers, number of seeds were maximum at 100% concentration of SLF, *Ulva fasciata* and *Sargassum swartzii* treated plants were (160± 4.08, 162.0 ± 4.08) and (158.0 ± 2.45 , 159.0 ± 3.27). The minimum number (110.0 ± 0.82) and (100.0 ± 0.82) was noted in the control plants (Table - 1).

Regarding shoot length, Root length and leaf area at 100% concentration of SLF (*Ulva fasciata* and *Sargassum swartzii*) showed maximum values such as 80 ± 1.00, 85 ± 2.42, 11.5 ± 1.67 cm, 12.5 ± 2.66 cm and 35 ± 1.86, 37 ± 1.69 cm^2. But the control plants showed only 60 ± 1.28 cm for shoot length 4 ± 0.85 cm for root length and 20 ± 2.66 cm for leaf area respectively (Figure - 1).

Effect of different concentrations of SLF of *Ulva fasciata* and *Sargassum swartzii* on the biochemical and pigment production by *Oryza sativ.*

The soluble sugar, protein and lipid of control and other experimental plants showed much variations. The biochemical constituent of *Ulva fasciata* and *Sargassum swartzii* treated plants showed maximum at 100% concentration and the values noted were 1.99 ± 0.13 mgg^{-1}DW, 3.0 ± 0.12 mgg^{-1}DW and 1.91± 0.11 mgg^{-1}DW, 4.26 ± 0.12 mgg^{-1}DW, 3.16 ± 0.15 mgg^{-1}DW and 2.12 ± 0.12 mgg^{-1}DW for sugar/ protein and lipid respectively. In other concentrations such as 50:50, 25:75, 75:25 the values were decreased and the control plant showed minimum values.

Like wise in pigment production also at 100% concentration the seaweeds *Ulva fasciata* and *Sargassum swartzii* showed maximum values for Chlorophyll a, Chlorophyll b and Xanthophyll pigment production. The values noted were 2.37 ± 0.07 mgg^{-1}FW, 2.04 ± 0.07 mgg^{-1}FW and 2.33 ± 0.11 mgg^{-1}FW for *Ulva fasciata* treated plants. But the control plant showed only 0.49 ± 0.02 mgg^{-1}FW, 0.21 ± 0.01 mgg^{-1}FW and 0.46 ± 0.03 mgg^{-1}FW respectively.

SLF of *Sargassum swartzii* influenal the Chlorophyll a, Chlorophyll b and Xanthophyll pigment production to its maximum at 100% concentration. The values noted were 2.90 ± 0.10 mgg^{-1}FW, 2.37 ± 0.11 mgg^{-1}FW and 2.57 ± 0.08 mgg^{-1}FW. In other concentration the pigment production gradually reduced. The control plant showed only minimum value of 0.39 ± 0.02 mgg^{-1}FW, 0.25 ± 0.07 mgg^{-1}FW and 0.36 ± 0.04 mgg^{-1}FW respectively for Chlorophyll a, Chlorophyll b and Xanthophyll pigment production.

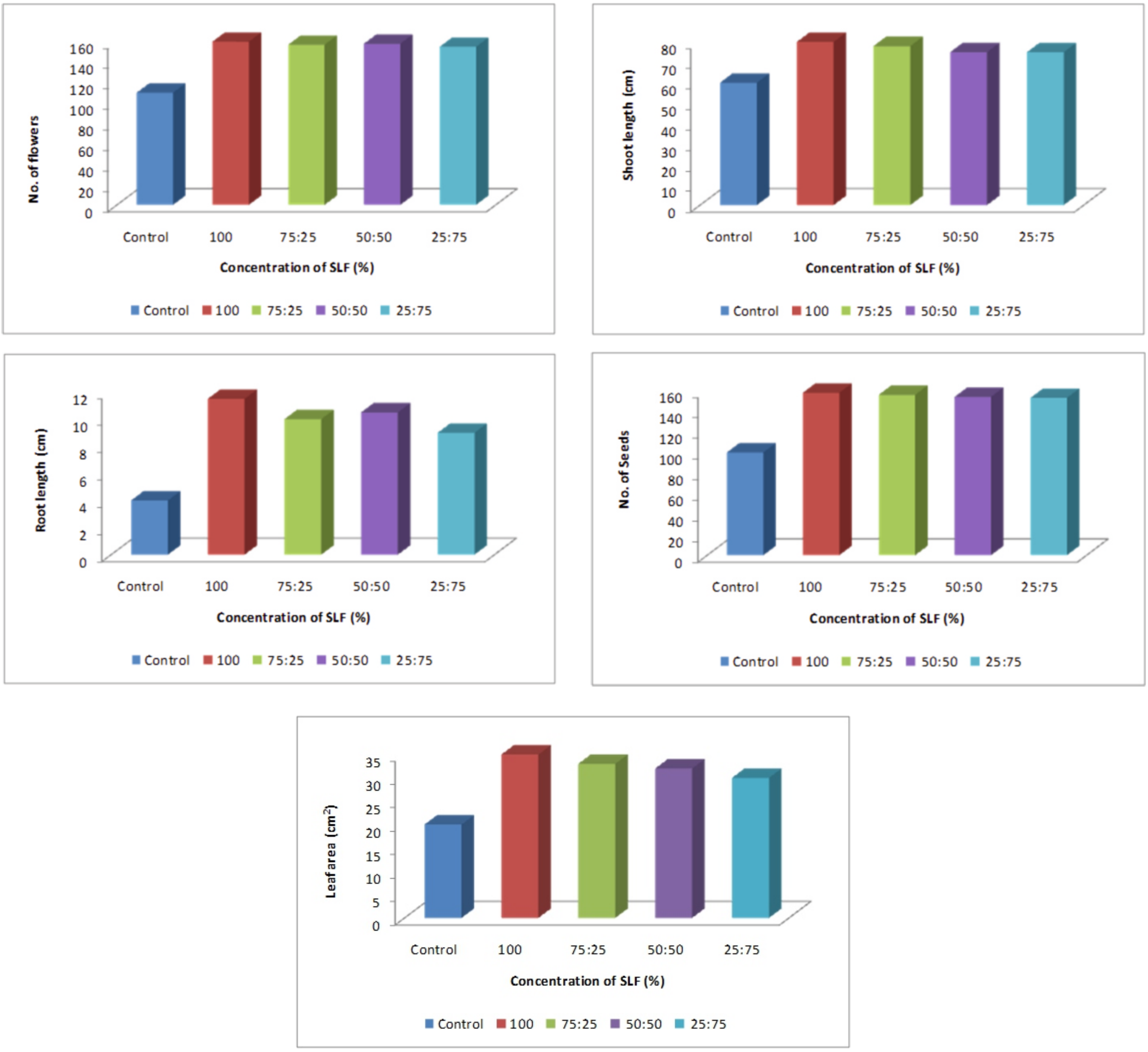

Fig. 1: Effect of different concentrations of SLF of *Ulva fasciata* on No. of flowers, Shoot Length (cm), Root Length (cm), No. of seeds and Leaf area (cm^2) of *Oryza sativa*

Table 1:
Effect of different concentrations of SLF of *Sargassum swartzii* on different growth parameters of *Oryza sativa*

Parameters	Control	Concentration of SLF (%)			
		100	75 : 25	50 : 50	25 : 75
No. of flowers	110 ± 0.82	162 ± 4.08	158 ± 2.45	155 ± 1.63	157 ± 0.82
Shoot length (cm)	60 ± 1.69	85 ± 2.42	70 ± 1.89	69 ± 2.66	68 ± 1.27
Root length (cm)	4 ± 1.27	12.5 ± 2.66	9.5 ± 1.89	9.01 ± 1.68	8.5 ± 2.42
No. of seeds	100 ± 0.82	159 ± 3.27	155 ± 2.45	153 ± 0.82	150 ± 1.63
Leaf area (cm^2)	20 ± 2.66	37 ± 1.69	28 ± 1.27	26 ± 2.42	25 ± 1.89

Each value is the mean ± SD of three individuals

4. DISCUSSION :

Seaweeds are one of the most important marine resources of the world. Seaweed extracts have been marketed for several years as fertilizer and additives (Booth, 1965). These extracts have increased the yield of crops, seed germination, resistance to frost, fungal and insect attacks and uptake of inorganic nutrients. Utilization of seaweeds as seaweed liquid fertilizer (SLFs) for the enhancement of growth and yield of C_3 plants is one of the excellent means to bring the nutrients from the ocean to the land. The present study was carried out to study the efficacy of green and brown seaweed applied to C_3 plant *Oryza sativa.*

The effect of seaweed liquid fertilizer of *Ulva fasciata* on biochemical constituents of *Oryza sativa* gives an clear evidence that seaweed liquid fertilizer treated plants resulted in the highest amount of soluble protein and lipid content when compared to the control plants. SLF of Ulva and *Gracilaria* treated drought stressed cow pea seedlings showed highest amount of sugar. Similar observation was made in paddy with SLF of Ulva which resulted in maximum sugar content Blunden *et al.* (1981) while studying the application of commercial seaweed extract on sugar beet reported that there was an increase in root sugar content. Accumulation of sugar during stress period might help to retain the cell osmotica under stress condition (Arunkumar *et al.*, 2002).

In untreated paddy plants, the protein content was found to be lesser. The reduction of protein content was directly related to protein synthesis. A stimulation of protein synthesis has also been reported in salt resistance Barley plant (Helal *et al.*, 1975). The increased growth and biochemical constituents are possible due to the SLF which induced absorption of essential nutrients and the related increased enzyme activity (Thirumal Thangam *et al.*, 2003).

In the present investigation, the application of SLF increased the pigment production such as Chl-a, b, xanthophyll pigment production in most of the concentrations tested. 100% concentration of SLF influenced the pigment production. In earlier studies too increased levels of photosynthetic pigments were recorded in SLF treated ragi plants (Venkataraman Kumar and Mohan, 1993). On grape seaweed extract increased the leaf chlorophyll concentration more than the traditional iron chelate concentration.

In general, the Indian soils are depleted of micro and macro nutrients (Thangaraju, 2001). The SLF of *U. fasciata, S. swartzii* and *S. hypnoides* contain not only the micronutrients such as nitrogen, phosphorus and potassium but also micronutrients such as iron, manganese, zinc and copper in addition to plant growth regulators. But among the three seaweeds selected for the study, *S. swartzii* gave the best results compared to *U. fasciata* and *S. hypnoides*. The present study clearly indicated that aqueous seaweed extract is able to enhance overall growth in *O. sativa* plants compared to the control plants. Similarly, in the present study most of the parameters increased linearly with application of higher concentration of extract upto 100% and it would be interesting to test still higher concentrations of aqueous seaweed extract. The extract may be recommended in agriculture as a soil drench to increase yield of plants.

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